REMARKS

Claims 31-33, 53-64 and 67-74 are currently pending. Claims 34-52, 65, 66 and 75 have been cancelled, without prejudice, in response to the restriction requirement imposed by the Examiner. Claims 72, 73 and 74 have been amended to require that the catalyst is a "non-metallocene" catalyst. This amendment is supported throughout the specification and claims as originally filed, and most specifically at page 8, lines 4-5, where it is stated that an object of the current invention is to produce isotactic polypropylene with non-metallocene group 4 polymerization catalysts. No new matter has been added. The purpose of this amendment is to more specifically claim the invention of claims 72, 73 and 74

Restriction/Election of Species

The Examiner has required restriction of the present application between two groups: Group I, directed to a polymerization process as recited in claims 31-33 and 53-74, and Group II, directed to an isotactic polypropylene as recited in claims 34-52 and 75. The applicant confirms the election of the Group I claims for prosecution in this application. In accord with this election, claims 34-52, 65, 66 and 75 have been cancelled in this paper.

The Examiner has also required an election of a single species for examination. By telephone, on January 11, 2005, the applicant elected the species defined by Formula C1 of Examples 1-4. The applicant confirms this election. The Examiner indicates in paragraph 5 of the Office action that the elected species is novel. Therefore, the search was extended to the rest of the species. The applicant does not amend the application in view of the election of species requirement.

Claim Objections

Claims 31-33, 53-64 and 67-71 stand objected to because of "vertical bars" in the formula structures. The applicant can find no such vertical bars in the formulas. It is possible that electronic "cutting and pasting" of the formulas lead to some vertical bar looking artifact. The applicant has replaced the "pdf" formulas with redrawn formulas that more smoothly

integrate into the word processing software. No amendment to the formulas was made; only a different type of file was used to insert the formula structures into this document. Hopefully, the different file format will eliminate the vertical bars that the Examiner objects to.

Double Patenting

Claims 31-33, 53-64 and 67-71 stand rejected under the judicially created doctrine of obviousness-type double patenting in view of claims 1-17 of U.S. Patent 6,706,829. To overcome this rejection, the applicant submits with this response a terminal disclaimer to disclaim the terminal end portion of a patent granting on this application.

Rejection of Claims 72 and 73

Claims 72 and 73 stand rejected as allegedly anticipated under 35 U.S.C. §102(b) or obvious under 35 U.S.C. §103(a) in view of Okumura et al. (U.S. Patent 6,121,182). The applicant traverses this rejection. As set out in the Office action, Okumura teaches the solution polymerization of propylene into isotactic polypropylene in the presence of a metallocene catalyst. Okumura discloses a broad range of polymerization temperatures ranging from 0°C to 300°C. The examples of Okumura are telling, however. Specifically, there are working examples showing polymerization temperatures at 30°C and 50°C, with the Examiner citing to Tables 1 and 2 in columns 37 and 38.

Okumura does not anticipate claims 72 and 73 because the metallocene catalysts of Okumura have been excluded from the claimed invention of these claims. Also, it would not have been obvious to extend Okumura to non-metallocene catalysts to produce isotactic polypropylene having the claimed properties under the claimed conditions. More specifically, the polymerization temperature is critical in view of the fact that the critical temperature for propylene at about 92°C and the critical pressure is about 668 psia (see, for example, http://www.flexwareinc.com/gasprop.htm). As those of skill in the art understand, when the polymerization reaction temperature increases past the critical temperature, the concentration of propylene in the polymerization reaction drops because its solubility drops (see below). This drop in concentration affects the properties of the metallocene produced isotactic polypropylene. As one review article stated:

> Several C_2-I-type zirconocenes have been investigated. Both isotacticity and molecular weight of *i*-PP decrease by increasing T_p, while the amount of secondary insertions, when present, increases slightly. For example, upon increasing T_p from 20 to 70 °C, C_2-I-**1**/MAO yields polypropenes with decreasing $\bar{M}_v$ values from 56 000 to 19 600, percent *mmmm* pentads from 92 to 83%, and corresponding melting temperatures from 142 to 125 °C. Furthermore, the overall fraction of regioirregularities (2,1 and 3,1 insertions) increases from 0.4 to 0.7%. C_2-I-**9**, which is slightly less isospecific than C_2-I-**1**/MAO due to a wider "bite angle" β (see Table 1), produces *i*-PP with percent *mmmm* pentads decreasing from 88 to 77% by increasing T_p from 20 to 70 °C. The regioselectivity of C_2-I-**9** is slightly higher (percent 2,1 insertions from 0.1_4 at 0 °C to 0.6_0% at 70 °C) than that of C_2-I-**1**. It is worth noting here that there is no detectable 2,1 → 3,1 isomerization with C_2-I-**9**/MAO, as only 2,1-*erythro* and 2,1-*threo* units were observed (see section VII.A for details). As the 2,1 → 3,1 isomerization reaction would be faster (relative to the following primary insertion) than epimerization, its absence (or very low extent, as in C_2-I-**1**/MAO) is an indication of the absence of epimerization in liquid monomer.

From page 1310 of "Selectivity in Propene Polymerization with Metallocene Catalysts", *Chem. Rev.* **2000**, *100,* 1253-1345 (a complete copy of which is submitted herewith).

Others recognize the difficulty of using metallocene to produce isotactic polypropylene having desirable properties at a temperature above the critical temperature of propylene. For example, WO 2004/026921 states, "Polypropylene production in high pressure conditions has, however, been seen as impractical and unworkable at temperatures much above the propylene critical point." (in paragraph [0003], submitted herewith). Thus, much metallocene catalyst research has focused on moving to supercritical conditions to try and obtain isotactic polypropylene having desirable properties.

Based on this understanding, the applicant does not agree with the Examiner's reasoning on page 6 of the Office action. The Examiner reasons that since there is "little change" between the properties of isotactic polypropylene produced at 30°C and 50°C as shown in Examples 6-9 of Okumura, "one would have expected there should be little changes in Tm and mmmm when Okumura's polymerizations are conducted at higher temperatures." The reasoning fails because one of skill in the art would have expected the exact opposite, namely that the properties of the

produced isotactic polypropylene with metallocene catalysts would change dramatically over this temperature range due to dropping propylene concentration in the solution reaction.

The applicant submits that this reasoning, supported by the literature citations, meets the burden of overcoming the reasoning advanced by the Examiner in view of Okumura.

Rejection of Claim 74

Claim 74 stands rejected as allegedly obvious under 35 U.S.C. §103(a) in view of Okumura et al. (U.S. Patent 6,121,182). The applicant traverses this rejection. As set out in the Office action, Okumura teaches the solution polymerization of propylene into isotactic polypropylene in the presence of a metallocene catalyst. Okumura discloses a broad range of polymerization temperatures ranging from 0°C to 300°C.

As discussed above with regard to claims 72 and 73, Okumura does not disclose or suggest non-metallocene catalysts operating in the claimed process to make a polypropylene product having a molecular weight above 100,000. Indeed, the examples of Okumura are telling. Okumura shows working examples having polymerization temperatures at 30°C and 50°C, with the Examiner citing to Tables 1 and 2 in columns 37 and 38. Thus, although Okumura alleges a polymerization temperature above 110°C, there is no example supporting this allegation.

There is no evidence in the prior art cited that supports moving from metallocene catalysts to non-metallocene catalysts to render the claimed process obvious.

In sharp contrast to metallocene catalysts (such as those disclosed in Okumura) that are run in solution polymerization processes, the processes and catalysts as claimed in this application can be run at higher polymerization temperatures. The processes and catalysts of this invention are capable of polymerizing propylene to isotactic polypropylene at an operating temperature above the critical solubility temperature of 92°C without the substantial reduction in the polymer properties that metallocene catalysts produce. Traditional isotactic polypropylene production processes operate below the critical temperature and as a consequence many of them are in bulk liquid propylene, e.g., the highest monomer concentration possible. If the polymerization reaction temperature for a solution process is to be at a commercially acceptable level, namely above 92°C, then bulk liquid monomer cannot be used because the temperature is above the critical temperature. Any catalyst would necessarily need to operate at these higher

temperatures and lower monomer concentrations. Metallocenes (like those in Okumura) cannot do this, hence the novelty and non-obviousness of the claimed invention.

Claim 74 therefore is not obvious in view of Okumura.

CONCLUSION

In view of the foregoing, the applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If necessary, the Examiner is hereby authorized to charge any fees required in connection with this application, throughout the pendency thereof, to Deposit Account No. 50-0496.

Respectfully submitted,

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Ronald A. Krasnow
Reg. No. 33,321
Attorney for Applicant

Symyx Technologies, Inc.
3100 Central Expressway
Santa Clara, California 95051
Tel.: (408) 773-4024
Fax: (408) 773-4029